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as *variation.* Inheritance struggles to have the plant fertilize itself with its own pollen; whilst the efforts of variation are towards an intermixture of races or even neighboring individuals, rather than with members of the one brood or family. May it not be possible that at some time in their past history all species of plants have been hermaphrodite? that Diœcism is a later triumph of variation, its final victory in the struggle with inheritance? There are some difficulties in the way of such a theory, as there are with most of these theories; but it seems clear from this case of *Epigæa* that cultivation has not so much to do with changes as it gets credit for, and we may readily believe that, independently of external circumstances, there is a period of youth and a period of old age *in form* as well as *in substance*, and that we may therefore look for a continual creation of new forms by a process of vital development, just as rationally as for the continued succession of new individuals.

The discovery of diœcism in *Epigæa* is interesting from the fact that it is probably the first instance known in true *Ericacæa.* In the *Ericale* suborder of *Francoacœa*, abortive stamens are characteristic of the family, and in the *Pyrolacæa* antherless filaments have been recorded.

Monœcism in LUZULA CAMPESTRIS.

BY THOMAS MEEHAN.

The recent discovery, that many plants structurally hermaphrodite are practically monœcious or diœcious, in consequence of the flower being so arranged as to prevent self-impregnation, is so interesting that every additional fact bearing on the subject has a value.

Luzula campestris, D. C., adds another to the list. The three stigmas are protruded through the apex of the flower bud some days before the sepals open and expose the anthers. In the specimens I marked for observations, six days elapsed before the flower opened, after the pistils had been protruded to be operated on by the pollen of other flowers. This was in a cloudy week, and probably the exact time might vary with the weather. In all cases the stigmas wither away before the flower opens.

After fertilization the stigmas generally twist around one another, and after the anthers have shed their pollen they twist in the same way, withering up in a very short time. An interesting fact in *Luzula* is the slight adhesion at the articulation of the subpedicels with the main flower stalk,—the gentlest force being sufficient to draw them out of their sheaths. It is perhaps owing to this weakness that the pedicels are often drooping when in fruit.

June 2d, 1868.

MR. VAUX, Vice-President, in the Chair.

Twenty-five members present.

The following papers were presented for publication:

"Description of seven new species of Unio from North Carolina." By Isaac Lea.

"Descriptions of two new species of Unionidæ from Equador." By Isaac Lea.

"New Unionidæ, Melanidæ, &c., chiefly of the United States." By Isaac Lea.

"On Agaphelus, a genus of toothless Cetacea." By Edw. D. Cope.

Dr. Leidy called attention to some specimens of Sombrero Guano containing about 90 per cent. of phosphate of lime. This substance was noticed some years ago by him under the name of Ossite. A similar material has been found near Charleston, S. C., in a post-pliocene formation.

E. D. Cope gave an account of his discovery of the fresh-water origin of certain deposits of sand and clays in west New Jersey, which he found to contain leaves of dicotyledonous trees, ctenoid fish scales, and numerous Unionidæ in a tolerably good state of preservation. The most important part of the deposit consisted of a heavy black clay, which is used for making brick, which rests on a bed of hard laminated clay, with a thin layer of iron-stone between. The clay bed, at one place examined, is 25 feet in thickness, and at from one to three feet from its bottom occurs a bed of fresh water mussels. These are Unios and Anodontas of six species, all of them, as pointed out to him by Dr. Lea, hitherto undescribed, and having some analogy with those of the Wealden, procured by Dr. Mantell in England. The beds are from the top of the clay down, conformable, and have a dip of about 25° to the south-east. The upper surface of the clay is worn into holes, which are filled by the material of a bed of coarse gravel of little depth, which covers the whole. Above this is a bed of fine sand, varying from six to fifteen feet in thickness to the soil. The point at which the section is visible is in New Jersey, on the banks of the Delaware, about six miles above Camden, N. J.

These deposits belong to Meek and Hayden's Earlier Cretaceous, No. 1, which contains abundant remains of leaves on the Raritan River, but no animal fossils. Their age has been heretofore quite uncertain; they have been stated by Meek and Hayden to be the earlier division of the later Cretaceous of the general geologic series. They extend across the States of Delaware, Maryland and Virginia. In Maryland they are stated by Ducatel to contain the important deposits of carbonate of iron; and Philip Tyson, State Geologist, informs me that these beds lie upon the red and blue clays, forming hills, which have been produced by erosion of the valleys to the beds below. These iron clays contain several species of Cycadaceous plants, whence Tyson infers the age of the clays to be Jurassic, and not Cretaceous.

There are in the Museum of the Smithsonian Institution, Washington, several specimens of fossil Unios, from a ferruginous clay which crops out at some elevation on the banks of the Potomac. These species are identical with those which have been found in the New Jersey clays, and the deposit is doubtless the same as that which traverses the State of Maryland.

Indurated grey clays on the Rappahannock River have been examined by my friend Philip R. Uhler, of Baltimore, who has obtained from them leaves and stems of some six species of plants, in beautiful preservation, of the orders Cycadaceæ, ? Gnetaceæ and Filices. The position and character of this bed renders it exceedingly probable that it is a continuation of those of Maryland and Alexandria.

The whole formation indicates the existence of an extended body of fresh water, having a direction and outline similar to that in which were deposited the red sandstones and shales of the Triassic belt, which extends parallel to its north-west margin throughout the States in which it occurs, separated, except in New Jersey, by a broad band of Gneiss, and Potsdam rocks. The carbonate of iron was no doubt deposited in a bog or bogs along its margin or in its shallows, as the bottom became elevated, as suggested by Tyson,—though not in a salt-water swamp, as supposed by him. The cycads and dicotyledonous trees grew in the swamps and on the shores, while terrestrial reptiles of large size no doubt haunted their shades.

These beds appear to dip conformably beneath the lower Cretaceous marine beds in New Jersey, in which, at a distance of a few miles from their border, occurred the remains of the Hadrosaurus; and it is therefore not probable that they were cotemporary with these, as is the case with the Wealden of Kent and the Cretaceous at Maidstone, England. The Hadrosaurus clays, belonging to the upper Cretaceous, as indicated by the presence of many molluscs of the Ripley Group of Mississippi, appear indeed to be separated from the clays in question by a great lapse of time. The age is therefore probably truly Wealden or Neocomian.

These facts indicate the existence of a barrier to the eastward of their present position, which for a long period prevented the access of salt water. This barrier was no doubt an anticlinal of the Appallachian series, outside of that which walled in the Triassic fresh-water area, and, like it, parallel with the general series of anticlinals of the present Allegheny range. That it was, like the latter, at one time submarine, and, gradually rising, finally enclosed the area in question, the waters of which soon became fresh, from the numerous rivers which flowed into it.

On the gradual elevation of this fresh-water valley, with its included beds of clays, etc., the Delaware river cut its way through the latter nearly to the south-eastern rise, and was then deflected along the base of these first elevations of the bounding anticlinal, in a south-west direction. Thus is accounted for the apparently singular phenomenon of the great bend of the Delaware River, near Bordentown. For after penetrating the high ranges of the Blue Mountains, it remains to be turned, apparently, in a level country of sands and clays.

We must suppose the coast line to have been not far from the south-eastern base of this anticlinal, and that a subsequent submergence brought the marine deposits near to the margin of the fresh, and gave the latter the south-east dip visible at the section at the Pea Shore. I have not yet been able to ascertain the relative position of the margins of these beds, nor the nature of those that conceal the supposed anticlinal. A system of borings at a distance of two or three miles from and parallel to the Delaware, would do much towards explaining this point. It is to be hoped that this may be undertaken by the present State Survey, under Prof. Cook.

At the present time, the cities of Alexandria, Washington, and Baltimore stand upon its deposits, and Philadelphia is probably underlaid by its margin, as well as the adjoining margin of the Gneiss. Indeed, the location of the prominent cities of the Atlantic States appears to have been determined by the fine sites and water-powers offered by the junction of the high rolling country of the Gneiss formation, and the lower and more level regions of the supposed Neocomian, Cretaceous and Tertiary. Where the Gneiss strikes the ocean, is situated our greatest seaport, New York. Trenton, Philadelphia, Wilmington, Baltimore, Washington, Alexandria, Richmond, Raleigh, Columbia, and Milledgeville, Georgia, are all on this line of junction. The elevated Gneiss hills furnish healthy and beautiful residences, the fall furnishes water-power, and the lower level, water communication, and a light soil most suitable for gardening and the production of provisions for these centres of population.

The succession of strata is rather more complete in New Jersey than has been generally supposed. At the basis of the series occurs the present fresh-water period. Then the marine Hadrosaurus or Ripley clays, and lower Greensand bed. This deposit my friend John Smock, first assistant of the State Survey of New Jersey, informed me had not found to contain Chelonians. On examination of my own collections and explorations, and those of the Academy, I find this to be true up to the present time. The Chelonians, then, have so far been found in the middle bed of green sand only. Third, the sands, green sand, and limestone pertaining to the middle bed. Lastly, the upper green sand bed, which appeared to approximate closely the London clay, or lower Eocene, in the character of its fauna, in its molluscs, according to Conrad, and especially in the genus of serpents, Palæophis of Owen.